

BRITISH JOURNAL OF TUBERCULOSIS AND DISEASES OF THE CHEST

Vol. XL.

April, 1946

No. 2

IN MEMORIAM

RODOLPH CHARLES WINGFIELD, B.M. (Oxon),
F.R.C.P. (Lond.)

Late Medical Superintendent of the Brompton Hospital Sanatorium, Frimley

By the death of Dr. R. C. Wingfield at Camberley on February 5 a gap which it will be hard to fill was made in the circle of those interested in the treatment and pathogenesis of pulmonary tuberculosis. He had been Medical Superintendent at Frimley for twenty-six years. He was the youngest son of Canon Charles Wingfield, who died when Wingfield was a boy, and was one of a large family who had claims to be able to trace their descent back to the Norman Conquest. After Canon Wingfield's death the family moved to Bruges, where Wingfield picked up a useful knowledge of both French and German. He was educated at Haileybury, where he distinguished himself more in the athletic than the scholastic world. At Trinity College, Oxford, he took up medicine and was placed Class II in the Final School in Natural Science. He played in the University Trials at Rugby football and boxed as a heavyweight for Oxford; in any ordinary year he would have won, but he was unfortunate in meeting John Hopley, who was probably the best heavyweight who ever boxed for either university. In 1908 he went to St. Thomas's Hospital and from there took his degree in medicine at Oxford. After qualifying he became house physician and Demonstrator in Pathology at the hospital. In the Pathological Department he came under the notice of L. S. Dudgeon and became Louis Jenner Research Scholar. It was while holding this appointment that he began to be interested in the pathogenesis of pulmonary tuberculosis in man. This problem was his life's interest, and although in the press of routine work it was frequently put to one side, he always returned to it when opportunity offered. In 1913 he was appointed Physician and Medical Superintendent of the Tuberculosis Department which the hospital had set up on behalf of the Lambeth Borough Council. With a new department to mould as he wished, Wingfield soon showed his ability as an organiser and clinician. The standard of work at this dispensary was extremely high and it was looked upon as the model dispensary in London. Throughout his life he was always conscious of the value of the experience which he gained in holding this appointment, as it enabled him to visualise the conditions both social and psychological to which his patients at the sanatorium would have to return.

Very much to his disappointment he was rejected for military service in the 1914-18 war on account of renal calculi, but he threw himself into his work with redoubled energy. He kept up his interest in pathology by acting as a deputy

in the post-mortem room at Brompton and so came into direct contact with that institution.

In November, 1919, he was appointed Medical Superintendent of the Brompton Hospital Sanatorium at Frimley, where he worked until he was compelled through ill health to retire in 1945. Frimley was Wingfield's life work, and his memorial the hundreds of men and women who were his patients there and are now alive and well. As an administrator he was in the first rank. The sanatorium was run on very economical lines, but nothing was spared that would benefit his patients; on the other hand, no money was spent on outside show; every penny spent on improvements had a definite object in view. Frimley was built for ambulant patients, as it was planned that patients would all come through Brompton, where the part of their treatment involving bed rest would be carried out, so it was not an easy place to administer when the type of patient changed. However, Wingfield got over the difficulties and the care given to patients who were very ill was admirable. But it was not only as an administrator that Wingfield will be remembered. Every patient to him was a separate problem and he knew the whole social and psychological background of each of them. Frimley had accommodation for 150 patients and he deprecated any suggestions that this number should be increased. He felt that it was impossible for any one man to look after more than this in the way in which he thought he should look after them; the character of the place would be changed. He took endless trouble over each patient and no detail was too small for him to consider. In the early days when facilities for pneumothorax refills were less widespread the problem of continuation of treatment was settled in his mind before the pneumothorax was started and the treatment of the individual was carried out with his future status in view. As a result, his patients put themselves completely in his hands and left the whole burden to him. The atmosphere at Frimley among the patients was exceptional and they were almost proud to have been there; if a relapse occurred, their one object was to get back. Part of this feeling was due to the air of self-confidence which Wingfield radiated around him, but it was justified by the thought which he gave to every problem before coming to a decision. The discipline at Frimley was strict, but there were many years in which no patient took his discharge against advice. Wingfield never spared himself, and every patient received the best he had. The staff at Frimley, both medical and lay, were devoted to him and this was one of the causes of the smooth-running of the place. The recently qualified men who came to him as house physicians were fortunate. He insisted on a high standard of work and attention to detail, though he was always ready to excuse human failings; as a teacher he was lucid and his dogmatism was founded on long experience; muddled thinking and generalisation he would not tolerate, though he was only too ready to discuss concrete problems. He was a first-rate clinician and was one of the small band of those who used artificial pneumothorax as a method of treatment on a large scale before nineteen-twenty. He realised before many of his contemporaries the value of radiology in the control of the treatment of pulmonary tuberculosis and made great use of it when many sanatoria had not yet felt the need for an X-ray apparatus.

Wingfield's style in writing was clear and easy. From 1920 onwards the medical press published a steady stream of articles from his pen on tuberculosis and allied subjects. He wrote three books, the first a small handbook on pulmonary tuberculosis for students, followed by a more elaborate textbook on the same lines. Later he wrote a small volume in which he elaborated his

theories on the development of the various types of the disease. His passion for exactitude, however, led him to use a terminology which made the book less popular than it would have been otherwise. As a co-editor of the decennial reports on the results of treatment at Frimley he became acquainted with statistical methods. This made him critical of all work which would not bear statistical analysis, and thus much of his own research work was not published.

He initiated and carried out with the help of Dr. Margaret Macpherson the first X-ray survey undertaken in England. A portable X-ray apparatus was used, as at that time the miniature apparatus was not available. The investigation was carried out on young factory workers. The results were published in 1936, and subsequent surveys have only confirmed his conclusions, though their authors have often failed to give him the credit that was his due. He was the moving spirit in the setting up of the research department at the Brompton Hospital; the long investigation into the development of childhood tuberculosis, carried out by a series of workers, was his conception and guided by him, although the results were not published under his name.

In 1942 he published his theory on the method of spread of tuberculosis in the lungs; time alone will show whether or not it is correct, but it does appear to answer many of the difficulties. He was the originator of the Brompton Hospital Reports, of which he was co-editor until 1945. For many years he was on the Council of the National Association for the Prevention of Tuberculosis.

When he first went to Frimley he was an enthusiastic golfer, but his interest in this waned and later his spare time was spent in his garden. He was a keen fisherman.

Wingfield was an individualist; he liked to work out his own problems in his own way. This led him to avoid committee work. In his later years he was seldom seen at medical meetings; he felt that so much of the time was taken up by speakers who had nothing new to say that his own time could be better employed.

He was a great humanist, and was a very wide reader on many subjects. This, with his sympathy with all who needed his help, made him a wise counsellor to his colleagues. The aspect of his character which impressed most deeply those who came in contact with him was his spiritual integrity. It was difficult to think or act unworthily or selfishly when with him. One knew instinctively that his actions would never be influenced by self-interest. He had a striking personality and appearance which made itself felt in any gathering. Those who could call themselves his friends were indeed fortunate; their only complaint was that they did not see more of him. His robust sense of humour, his singleness of purpose, and the twinkle in his blue eyes made him very dear to them.

The war brought much work and worry to him. Brompton evacuated most of its very sick patients to Frimley and a surgical unit was sent down. Wingfield managed to overcome all the difficulties, but the extra strain was a large factor in his early death at the age of fifty-nine.

He married Isabella Rose Paterson, daughter of the late Mr. and Mrs. Donald Paterson of Culloden, who survives him. The marriage was very happy, but they had no children.

F. H. Y.

GENERAL ARTICLES

**"EXTRAPERIOSTEAL PNEUMOTHORAX"
IN THE TROPICS**

BY O. PANETH

Kaban Djahe, Sumatra, Dutch East Indies

PULMONARY tuberculosis is very frequent among the 60 million inhabitants of the Dutch East Indies and mainly follows the same course as in Europe. Treatment, however, presents special difficulties; for instance, most of the natives are poor, a monthly income of 20 guilders (about U.S.A. \$10) being considered a good one for a family. Their simple needs are cheap, but nearly everything needed for treatment must be imported at high costs. The great majority of the population cannot pay for prolonged treatment in hospital or sanatorium. Social provisions for indigent patients are either absent or in an embryonic stage; thus out-patient treatment has to be practised much more extensively than in more advanced countries. Most of the people are poorly nourished; their meagreness is not due to constitutional factors, for the few well-to-do among them are nearly always more than fat enough. Housing conditions are bad: a whole family and a varying number of casual visitors are likely to sleep on the floor of a single small room, so favouring frequent massive infections. Other chronic diseases, such as malaria, ankylostomiasis, frambæsia, are common and may impair resistance. Moreover, the people are mostly ignorant and attribute diseases of unknown origin to evil spirits and magic influence which must be combated by incantations, etc. As a rule they come to a doctor only very late and fail to co-operate when they do.

There are therefore in the Dutch East Indies a large number of advanced, mostly bilateral cases of pulmonary tuberculosis urgently needing collapse therapy. Without it they are certainly lost; even when it succeeds the prognosis is doubtful. In most cases collapse treatment must be applied without delay to prevent fatal spread, and continued as an out-patient treatment after a short period. In my practice, during the first month of a patient's stay artificial pneumothorax and intrapleural pneumolysis are frequently performed on both sides, with certain special precautions. This can be done safely and with gratifying results. But a great number of patients have such extensive adhesions that effective pneumothorax is impossible: some additional operation is required. It soon became evident to me that ordinary thoracoplasty is unsuitable for the majority of these cases; they could not stand an operation extensive enough to collapse their cavities. Operating in stages costs much more time and money. Besides, it is not always easy to persuade an Indonesian to a single operation, let alone to a whole series, and not a few object to having so many bones removed, fearing pain, disfigurement and disability.

The difficulty was to find an operation fulfilling the following demands:

(1) It must be tolerated by patients in poor general condition, febrile, with high pulse rate and low blood pressure. Among primitive people every fatality during or shortly after operation is likely to cost the life of more than one patient, because it deters others, who could be saved, from undergoing the necessary operation. (2) Satisfactory collapse must be attained by a single operation. (3) It must be applicable in the presence of progressive lesions and subpleural cavities; this rules out extrapleural pneumothorax. (4) Shock, pain, discomfort and disfigurement must be negligible.

After more than a few errors I developed an operation which seems to fulfil these demands to a considerable degree: A pneumothorax is established situated not only outside the pleura, but also outside the inner periosteum of the ribs and most of the intercostal muscles. These structures remain on the collapsed lung. They are well vascularised and seldom involved in the tuberculous process; the surface they have to cover is greatly reduced by the lung collapse, so they form a rather solid layer between diseased lung and pneumothorax to protect the latter against contamination. An important advantage, considering that nearly all complications of artificial pneumothorax, intrapleural pneumolysis and extrapleural pneumothorax—complications materially impairing the ultimate results of these methods—are due to one fundamental drawback: a big artificial hole is created dangerously near to infected tissue. In "extraperiosteal pneumothorax" this danger is much more remote, though not completely absent, for the structures of the thoracic wall may become involved in the tuberculous process. In point of fact, infection of the pneumothorax from the lung was not found in any of 111 cases hitherto operated upon and all operation wounds healed by first intention. Some of the cases were observed for longer than two years after operation.

Apicolysis forms no part of the operation, as it is not without danger, and in this operation is also contra-indicated for mechanical reasons. Its danger is easily understood, since thoracoscopy has shown that adhesions between lung and mediastinum are very common and frequently too short to be severed without danger of injuring either the lung or mediastinal organs. Conditions are certainly not more favourable when the pleural cavity is completely obliterated, and what is forbidden to the cautery should not lightly be permitted to the knife. The results of Semb's operation can be excellent, but the reason given by him, that this is due to "concentric" shrinkage of cavities, seems not convincing. For experience with artificial pneumothorax gives ample evidence that concentric shrinkage is not essential for the closing of cavities. A "lateral" pneumothorax, allowing the lung to retract towards the spinal column, is sufficient in many cases: the cavity soon becomes slit-like, then disappears together with sputum and bacilli; whereas just after complete pneumothorax it may take a long time before the cavity walls come into contact. (Complete pneumothorax may, for other reasons, be preferable to a "lateral" one.) The explanation why Semb's operation in so many cases is superior to "simple" thoracoplasty is, in my opinion, the following one: The anatomical condition of the lung after "simple" thoracoplasty resembles the conditions after "lateral" pneumothorax (Fig. 1). But here the analogy ends; the cavity cannot shrink further, being surrounded, not by air, but by rigid walls; only at

its base there is lung tissue, and even this has mostly lost much of its elasticity. Apicolysis displaces the cavity downwards, frequently into the region of non-resected ribs, which in itself is no advantage; nevertheless, the chances of healing are greatly improved, as the cavity is now in the region of the voluminous and comparatively healthy lower parts of the lung, which through compensatory emphysema allow further shrinking. The great advantage of Semb's operation is, in my opinion, not that apical cavities can shrink concentrically, but that they can shrink at all; that makes it a valuable addition to thoracoplasty. But if a cavity is surrounded by a medium even more elastic than lung tissue—namely, the air of a pneumothorax (whether intrapleural, extrapleural or extraperiosteal)—not much can be gained by apicolysis and much may be lost.

After my return from the Far East (November, 1945) I found that a similar operation to that which I had been using had already been advocated by Ch. P. Bailey. His indications are about the same, but his technique differs from mine mainly on two points: (1) The ribs (except the first) are "completely denuded

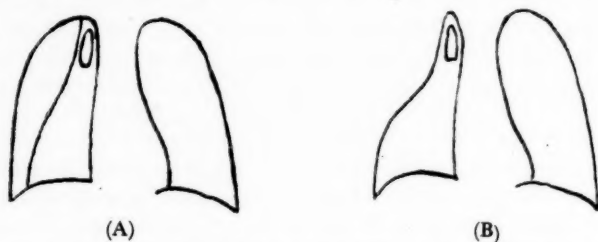


FIG. 1.—SHOWING EFFECTS OF (A) "LATERAL" PNEUMOTHORAX, AND (B) "SIMPLE" THORACOPLASTY.

of periosteum," apparently on the outer side too, which I do not consider necessary; (2) "a very extensive Semb apicolysis is performed."

Operative Technique

The operation can be performed through different approaches. In about a quarter of the cases I operated through an axillary incision, severing scarcely any muscles. But I have returned to the paravertebral route, chiefly because the important posterior apical parts are more easily accessible, and with muscle-splitting methods surgical shock is no greater than with the axillary method.

Before operation the patient is given morphia gr. $\frac{1}{2}$ – $\frac{3}{4}$ subcutaneously and gr. 15 of sodium bromide as a 10 per cent. watery solution intravenously. The pros and cons of local anaesthesia are known; I think the former outweigh the latter when operating on poor risk patients. Again, anaesthetising layer by layer seems preferable to nerve blocking because:

1. The total amount of anaesthetic ($\frac{1}{2}$ per cent. procain solution with adrenalin) is more evenly distributed over the whole time of the operation; 200 c.c. are easily tolerated in this way. Several of my patients showed a higher blood pressure after than before operation—probably due to the adrenalin.

2. When blocking intercostal nerves the needle is pushed past the rib edges; in doing this the lung may be punctured and, as it is far from sterile in these cases, the operating field might be contaminated.

3. Infiltrating tissues before dissecting them reduces hæmorrhage.

I generally place a deposit of 10-20 c.c. of the anæsthetic on the dorsal part of the second rib at the anterior border of the trapezius muscle, where the rib can usually be palpated under the skin and easily reached by the needle from the lateral side; it is easier still to do it when the patient is screened immediately before operation. A similar depot is placed on the first rib close to the sternum. These depots help to anæsthetise the anterior apical parts, somewhat difficult to reach from behind. This kind of anæsthesia has nearly always been very satisfactory. Only for a small number of hypersensitive patients should I have preferred general anæsthesia given by a trained anæsthetist; but this variety of *homo sapiens* has not yet been encountered in Sumatra. (I was the only doctor—and the only European—on the hospital staff.) That the operation takes somewhat more time with local than with general anæsthesia is a disadvantage for the busy surgeon, but hardly for the patient; indeed, if the shock of operation and lung collapse could be distributed over twenty-four hours, it would be a very good thing.

A paravertebral incision about 12 cm. long is usually sufficient. Trapezius and rhomboideus are split in the direction of their fibres; if necessary, a short vertical incision through the lower part of one or both muscles is added. After that, knife and scissors are laid aside and seldom if ever used again during the operation, which from now on is mainly carried out by blunt dissection, or "semi-blunt" dissection, most of it being done with a raspatory. I use almost exclusively an ordinary straight medium-size raspatory with rounded angles and a handle that can be lengthened by an extension when working in greater depth. Such a long instrument is essential; special raspatories such as those devised by Brunner, Doyen, Sauerbruch, Semb and others are sometimes useful, but seldom necessary; the same applies to different instruments of my own invention. The tip of the index finger is sometimes used; therefore I always wear cotton gloves outside the rubber gloves, which are too slippery and easily torn by bone edges. I never use gauze swabs to separate tissues because they exert pressure on too broad a surface. Muscles and connective tissue may be more resistant than diseased lung; if pressure is uniformly exerted on both, it may be the lung which is torn. An illuminating probe is good for the finishing touches, otherwise a strong forehead lamp is sufficient and less in the way.

Two ribs—usually the fourth and fifth—are resected subperiosteally from close to their transverse processes for a length of about 6 cm.; then the inner periosteum of the remaining parts is stripped medially and laterally to the desired extent. This causes the underlying lung to retract slightly, stretching the intercostal muscles between the two ribs. Then these muscles are grasped with long forceps and by "semi-blunt" dissection detached from the thoracic wall. If it is not possible to detach them *en bloc*, they are first divided into several strands, approximately in the direction of the intercostal spaces; these strands can easily be severed from the outer thoracic structures at a safe distance from the lung, which is held back and protected by a long spatula. Whenever there is any doubt about the right layer it is best to return to the adjacent ribs;

if their inner periosteum is neatly stripped to the very edges, the tissue between follows it, showing the correct plane of cleavage. Throughout the operation the aim should be to keep closely to the bone and away from the lung. The upper and lower ribs are not resected, otherwise the technique is the same: the inner surface of the bone is denuded and the intercostal muscles detached from the thorax to the same extent. In the region of the first and second rib this is generally done right up to the rib cartilages, but seldom further, for the perichondrium cannot be stripped as easily as the periosteum, and this involves the danger of injuring the lung. Medially, periosteum and intercostal muscles are detached up to the vertebræ.

Blunt dissection, though it looks somewhat crude, is in my opinion less damaging to the tissues than knife, scissors and ligatures. What is severed by gentle blunt dissection is mostly connective tissue; the more important structures, especially bloodvessels, remain intact, whereas the knife cuts indiscriminately through everything, and every ligature means necrotic tissue. A certain confirmation of this opinion may be found in the fact that, to my own astonishment,

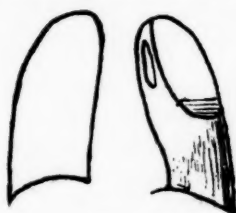


FIG. 2.

the whole operation could be performed in a number of cases without tying or coagulating a single bloodvessel (especially when operating through an axillary incision); in all other cases the number of ligatures has been small, about four to eight. Hæmorrhage during pneumolysis has always been insignificant: post-operative hæmorrhage occurred only in one of my early cases, when I used knife and scissors much more than now, and this patient recovered after blood transfusion.

The extent of the operation depends on two factors: the condition of the lung and the patient's general state. The collapse should be made, if possible, somewhat more extensive than anatomical conditions seem to demand, but, at all events, considerably less extensive than the patient seems able to stand. For the most critical time may come several hours later, when the vital capacity of the lung is further impaired by traumatic oedema of the inner chest wall, a feature invariably shown on X-rays taken a few hours or days after operation in the form of a broad dark line alongside the thoracic wall melting into a diffuse basal haziness (Fig. 2). It disappears in about a week's time.

When pneumolysis is completed, the upper parts of the lung are collapsed against the mediastinum and covered by alternate strips of periosteum and intercostal muscles. The outer wall of the wound cavity is formed by the ribs (minus their inner periosteum) and by the thoracic muscles (minus most of the intercostales). Stripping the ribs of their inner periosteum does not seem to impair their vitality. I have never seen any untoward sequelæ. (Depriving a bone of its periosteum occurs also in an operation of a widely different kind, extirpation of the lachrymal sacculus, an operation I had often to perform here for *ulcus serpens cornæ* due to chronic dacryocystitis. In this operation the periosteum of the lachrymal bone is usually removed with the sack; this does not lead to disease of the bone, although the wound is infected. This experience encouraged me to deprive ribs of their periosteum to a gradually increasing extent.)

Before the wound is closed the detached periosteum is painted with a 10 per cent. formalin solution, and a rubber drain inserted through a lateral stab incision situated about 5 cm. below the bottom of the wound cavity. It is not inserted through the original incision because every drain exerts pressure on the surrounding tissue, leading to local ischemia and occasionally to superficial necrosis. Such tissue is likely to become infected in the presence of bacilli, and as these are always present on and under the surface of the epidermis a small focus of infection is apt to develop where the drain emerges through the skin. This may be dangerous near a big wound cavity. But if the drain passes through a long canal and is removed after twenty-four hours there is no danger, as the bacilli cannot, in so short a time, grow into the wound cavity. The advantages of a temporary drain are considerable. Surplus exudate can be removed (constantly or intermittently) to relieve excessive pressure; connected

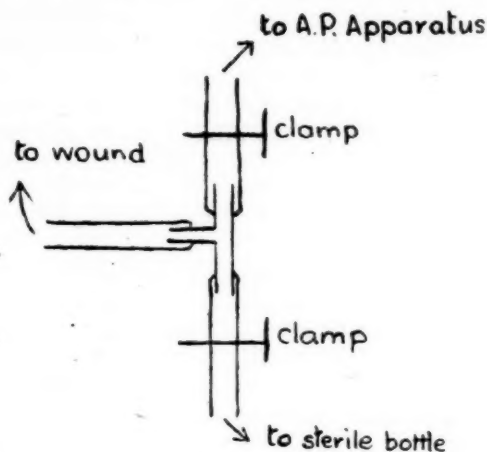


FIG. 3.

with T-tube and pneumothorax apparatus (Fig. 3), the wound cavity is easily refilled and the pressure controlled during the first period after operation. There may be still another reason for temporary drainage: Years ago I tried re-injecting into the blood stream the first portion of the discharged liquid, as it consisted mainly of sterile blood. I gave 5 c.c. in one case and 10 c.c. in another; both patients had rigors and a sharp rise of temperature, subsiding within a few hours without consequences. But this suggested that the exudate contains toxins and is better drained off than absorbed.

Post-operative Management

After the skin wound is closed a light pressure dressing is applied by means of rubber bandages and adhesive. To ensure uniform pressure, the bandages are fastened over a splint; as such, the thin wooden covering leaves of bamboo are very convenient, having the right curvature and little weight. A piece big enough to cover the whole area weighs not much more than a penny and costs

much less—in Sumatra. Immediately after operation the patient is screened and the pneumothorax brought to the right pressure (about plus 4, plus 6); this is frequently checked during the following hours, the exudate allowed to flow off and air added if necessary. If the patient coughs much this must be done frequently, as air escapes from the pneumothorax, leading to intramuscular and subcutaneous emphysema. In such cases repeated small doses of morphia, about gr. $\frac{1}{2}$ at a time, are indicated. I usually combine them with adrenalin, as bronchial spasm may play a rôle in retention of sputum and atelectasis.

After twenty-four hours the drain is withdrawn and the stab incision closed. From now on the exudate is removed by needling, and air introduced in the usual manner. Both are done in the X-ray room, the patient sitting in front of the apparatus. I usually tap off the exudate when it fills more than half the pneumothorax; the most convenient spot for needling is generally the anterior part of the first or second intercostal space. For introducing air the pneumothorax needle is usually inserted into the first intercostal space above the clavicle, horizontally and parallel to the anterior border of the trapezius; the needle point then lies in the cupola of the thorax and the patient can easily be screened during insufflation. Frequency and amount of refillings depend of course on X-ray findings and on the pressure in the pneumothorax. Skin sutures are removed on the fourth or fifth day after a row of clips has been inserted between them; this causes hardly any pain and allows the skin wound to remain firmly closed for ten days without producing ugly marks, the clips being removed after four to five days.

If extraperiosteal pneumothorax has to be established in the presence of a basal ordinary pneumothorax, which can be done with very good results, it is advisable first to produce a sterile pleurisy by injecting some irritating substance such as sanocrysin into the pleural cavity, as otherwise the pleura may be torn during operation; after a few weeks it is sufficiently thickened. An extraperiosteal pneumothorax can be converted into an oleothorax after a few months; this is of special value in patients who are not likely to attend regularly for after-treatment; in Sumatra, such patients form the great majority.

Results

Unfortunately, the extreme difficulty of securing even a short follow-up of native patients makes any estimate of ultimate results impossible, but immediate successes were frequent. Nearly all patients, most of them very bad bilateral cases, stood the operation without difficulty; its effects on cough, sputum, bacilli, and general condition were often striking.

Of individual examples, that of a Malay woman about 30 years old was fairly typical. She had a tuberculous cavity about the size of an orange in the left upper lobe. A few weeks after extraperiosteal pneumothorax the cavity was no longer visible, cough nearly absent and sputum free from tubercle bacilli. Later on she had a baby which she nourished herself without recurrence of her disease, and the child's Mantoux reaction, repeatedly tested, always proved negative.

Another patient, a Dutch woman with bilateral disease, 35 years old, had an extrapleural pneumothorax on the right side performed in Switzerland after

two years of unsuccessful conservative treatment. She came to Sumatra with no more signs of cavitation on the operated side, but with a cavity about the size of a prune in the left upper lobe and a positive sputum. After extraperiosteal pneumothorax on the left side (1942) the cavity soon became invisible and the sputum negative. Both pneumothoraces were converted into oleothoraces. Later on she was put into a concentration camp by the Japanese; she volunteered to go to prison instead of another woman, where she lost 20 kg., but in spite of this had no recurrence of the disease. When I saw her after liberation (October, 1945) she had regained her normal weight (72 kg.): physical and X-ray examination showed no signs of active disease and sputum was still negative.

There were, among 111 cases, two fatalities probably due to the operation. A European developed pneumonia on the other side, probably tuberculous, and died eight days after operation. The other, a Chinese woman with serious bilateral disease, died suddenly a few days after operation; post-mortem revealed, apart from extensive bilateral phthisis, a complete concretio pericardii cum corde.

It is unlikely that I shall ever be able to follow up a sufficient number of patients, working as I was among people who are for a great part illiterate, frequently without permanent abode, and generally not inclined to see the doctor unless desperately ill.* This handicap, together with other difficulties, made me reluctant to publish my experiences at all; and I do so now only because preliminary successes seemed to indicate that the leading principles were on the whole sound, and that the operation appeared to offer to a very large group of cases a prospect of relief that other lines of treatment failed to give.

Summary

1. In the Dutch East Indies there is a large number of serious, mostly bilateral cases of pulmonary tuberculosis who can be saved only by promptly applied collapse therapy.

2. In many of them, neither intra- nor extra-pleural pneumothorax nor thoracoplasty can be done with reasonable prospects of success.

3. For such cases a special operation, extraperiosteal pneumothorax, has been devised, which establishes a pneumothorax situated not only outside the pleura, but also outside the inner rib periosteum and intercostal muscles. These structures remain on the collapsed lung, protecting the pneumothorax against contamination, and so the operation can be done even in the presence of progressive lesions and subpleural cavities.

4. In 111 cases the operation gave good initial results, with only two deaths. The late effects are not known.

LITERATURE

BAILEY, CH. P. (1942), *Journ. Thor. Surg.*, 11, 326.

* An original paper was written in 1942 not long before the Japanese invaded Sumatra. Two copies were sent by different routes to the *Journal of Thoracic Surgery*; neither reached its destination. After liberation from a concentration camp in November, 1945, I could not return to Kaban Djahe on account of the "Indonesian Movement." The present paper is fairly accurately reproduced from memory, but X-rays and case records are lost.

EXPERIENCES WITH PROMANIDE IN TUBERCULOSIS

By R. GRENVILLE-MATHERS, DENNISON PICKERING AND
G. R. HALES

From Pendyffryn Hall Sanatorium, Penmaenmawr

IN 1941 Himshaw and Feldman reported their work on certain sulphone derivatives. They claimed that sodium *pp'*-diaminodiphenyl sulphone NN'-di-dextrose sulphonate (known in this country as promanide and in America as promin) arrests, although it does not completely suppress, tuberculous infection in guinea-pigs. In human beings it has been found to cause various toxic effects, of which anæmia, cyanosis, agranulocytosis and gastro-intestinal upset are the most important; and the work published so far shows that its therapeutic action is poor (Himshaw, Pfuete and Feldman, 1943; Heaf, Hurford, Eiser and Franklin, 1943; Dancey, Schmidt and Wilkie, 1944). The purpose of this paper is to give a short preliminary account of our own experiences with it.

SYSTEMIC ADMINISTRATION

We tried to make the evidence as to progress in the cases chosen as complete as possible for some time prior to, and following, the intravenous administration of promanide. In all cases clinical, radiological and hæmatological (E.S.R., differential white cell counts and von Bunsdorff's count) assessments were used. All patients received iron by mouth. No toxic effects sufficient to stop the administration of the drug were encountered, and no drop in the hæmoglobin level was noted.

Evaluation of a chemotherapeutic agent in tuberculosis is far from simple. The extreme variability of the course of the disease makes definite and very consistent evidence of improvement necessary to judge favourably of the efficiency of any drug.

Case Reports.

CASE 1.—Male, aged 52, 1943-44. Temp. 97.2°-99° F. E.S.R. 50. X-ray: (R.) Dense mottling upper zone with some "moth-eaten" cavities. (L.) Dense mottling upper and middle zones with "moth-eaten" cavities in upper zone. Shadows very soft. Promanide given intravenously for two months. Average daily dose 1.2 grams.

CASE 2.—Male, aged 25, 1943-44. Afebrile. E.S.R. 11. X-ray: (R.) Fine shading all zones. (L.) Medium mottling upper and middle zones with a large cavity in upper zone. Two months' course of promanide. Average daily dose 1.6 grams.

CASE 3.—Female, aged 26, 1943-44. Temp. 98°-99° F. E.S.R. 20. Exudative lesion in first and second interspaces on right side. Two months' course of promanide. Average daily dose 1.2 grams.

In Cases 1 and 2 no change occurred which could be attributed to the use of promanide. Case 3 deteriorated steadily.

These unfavourable results, together with the published experiences of other workers, led to our abandoning the systemic use of promanide in pulmonary cases. It appears that promanide will not arrest tuberculous infection

in man as it is reported to do in the guinea-pig. This may be due to a difference in the type of disease in the two species. Tuberculosis in the guinea-pig is an acute or sub-acute disease. In man the disease is chronic and the lesions are largely necrotic and non-vascular. Failure of promanide to affect human disease may thus be decided by the fact that the drug fails to reach the infected tissues in an adequate concentration. Even an intravenous drip has not proved effective (Zucker, Pinner and Hyman, 1942). Similar difficulty has been found in treating lung abscesses with penicillin (Pickering and Grenville-Mathers, 1945). That the effectiveness of the drug depends upon this question of access to the diseased tissues is supported by the work of Tytler and Lapp (1942), who applied the drug locally with success to tuberculous ulcerations. We have been able to confirm their findings in three cases of our own, and have also extended this local use.

LOCAL APPLICATION

Cold Abscesses.

Three cases have been treated. Each had pulmonary tuberculosis and developed a cold abscess in relation to the ribs or sternum. We aspirated as much pus as possible and injected 5 per cent. promanide made up in a thin base. If a sinus was present so that the promanide ran out following injection, a 5 per cent. jelly was used. The jelly was drawn up into the syringe through the nozzle and was then injected, no hypodermic needle being used. By this method no difficulty was encountered in using a thick jelly.

Case Reports.

CASE 1.—Male, aged 49, 1943. Rib abscess present which had formed two sinuses following aspiration. During the previous two years these had been injected with "Gomenol" and other antiseptics by various physicians with no result. July 1st: 2 c.c. pus aspirated; 2 c.c. jelly injected. July 12th: Redness diminished, sinuses dry and appeared to be closing. 2 c.c. jelly injected. August 19th: No discharge for two weeks. Two firm subcutaneous nodules present, probably fibrotic. No fluctuation. Small bead of pus present at opening of one sinus. 20 per cent. promanide in glycerine applied on wool, repeated on alternate days. August 28th: Healed. Seen eight months later. Hard fibrotic nodule present. Satisfactory healing.

CASE 2.—Male, aged 47, 1944. Previously had a cold abscess over lower end of sternum which broke down with the formation of a persistent sinus. Healed after two years. July 17th: Abscess on right side of sternum at level of second costal cartilage. Sinus discharging at lower pole. 2 c.c. promanide jelly injected. August 10th: Swelling much smaller. 2 c.c. promanide injected. August 30th: No pus present. Small hard nodule left.

CASE 3.—Male, aged 33, 1945. Large cold abscess over fifth right rib. April 16th: 5 c.c. pus aspirated; 3 c.c. promanide injected. April 17th: 12 c.c. pus aspirated. Abscess loculated. 5 c.c. promanide injected. April 23rd: 8 c.c. pus aspirated. 2 c.c. promanide injected. Pain and tenderness afterwards which settled in twenty-four hours. May 5th: 13 c.c. pus aspirated; 2 c.c. promanide injected. May 17th: Abscess hot and tense. Skin very thin over loculation at lower pole. 41 c.c. pus aspirated; 2 c.c. promanide injected. May 21st: Sinus present at upper pole at site of previous aspirations. 10 c.c. pus removed; 3 c.c. promanide injected. May 25th: Pus draining through sinus. 3 c.c. jelly injected. May 29th: Temperature 101° F. Abscess red and tense, sinus closed. Probe passed through obstruction. May 31st: Pus expressed through sinus. 5 c.c. 20 per cent. promanide in 20 per cent. glucose injected. June 5th: No discharge for seven days. Small opening at lower pole. June 9th: Two upper loculations healed. Little discharge through sinus at lower pole. Small cavity present under this, 1 c.c. promanide jelly injected. June 12th: 1 c.c. jelly injected. June 19th: Skin over cavity incised so that it could fall in. June 21st: 0.5 c.c. promanide injected. June 24th: Abscess cavity obliterated. Small area not covered by skin left. Jelly applied. July 21st: Raw area epithelialised over.

These results showing that promanide therapy is successful, provided that it can be brought into intimate contact with the diseased tissues in sufficient concentration, led us to extend its use to tuberculous laryngitis. All these cases had pulmonary tuberculosis with sputum positive for acid-fast bacilli on examination of a direct smear. Promanide was applied daily in the form of a spray. Local application is time-consuming and also requires skill—a factor which may militate against extensive use of this treatment. We used the Ayrton atomiser manufactured by Ayrton, Saunders and Co., Ltd., Liverpool, which produces a "mist-like vapour" with an aqueous 40 per cent. solution of promanide. It was found that all subjective discomfort disappeared in about a week with consequent psychological benefit to the patient. This brought its own troubles, especially in Case 9, in that it was very difficult to make the patients maintain silence.

CASE 4.—Male, aged 40, 1943. Voice husky. June 8th: Right vocal cord red and swollen with ulceration in posterior third. Put on silence. Spraying commenced. July 27th: Only posterior half of cord swollen. Ulceration nearly healed. August 11th: Vocal cords normal.

CASE 5.—Female, aged 36, 1945. January 29th: Complained of a little soreness in throat, voice hoarse. Some pain on swallowing acid drinks. Infiltration of interarytenoid region with oedema of left arytenoid. Spraying started. February 16th: No pain on swallowing lemon squash. February 20th: Raw lemon juice did not affect larynx. March 26th: A little oedema in left arytenoid. April 16th: Larynx clear. In all the larynx was sprayed seventy-five times. Although the patient was put on silence she did not co-operate and it is a fair presumption that the improvement was solely due to the promanide spray. During the time she was using the spray there was a steady deterioration in her pulmonary condition.

CASE 6.—Male, aged 41, 1945. Sore throat throughout winter of 1943-44. Cleared in spring without treatment. Recurrence in January, 1945. Condition steadily deteriorated and by April, 1945, voice was only a whisper. Severe dysphagia. Diagnosis of tubercular laryngitis led to discovery of pulmonary condition. Epiglottis and both arytenoids greatly swollen on admission. Nodulation of both cords with ulceration on right side. March 11th: Spraying commenced. April 16th: Voice improving. No pain on swallowing. Full diet. Epiglottis only half previous size. July 14th: No ulceration of cords. Arytenoids and epiglottis still swollen, but smaller. August 23rd: Voice normal. Epiglottis smaller but still oedematous.

A further three cases were found during the routine laryngoscopic examination of new patients, and it was decided not to inform them that the larynx was involved or to ask for any moderation in the use of the voice.

CASE 7.—Female, aged 41, 1945. April 25th: Voice a little hoarse. Infiltration of interarytenoid region with nodulation of cords. Spraying commenced. May 21st: Appearances improved. June 11th: Larynx clear.

CASE 8.—Male, aged 29, 1945. Army E.N.T. specialist's report while awaiting admission—cords red, no specific change seen. April 19th: Complained of throat being sore at night. Cords red and thickened. Both arytenoids swollen with infiltration of interarytenoid region. Spraying commenced. May 21st: Larynx improving. June 11th: Interarytenoid region clear. Arytenoids still swollen but smaller. July 14th: Larynx clear.

CASE 9.—Male, aged 59, 1945. Voice hoarse since December, 1944. No dysphagia. July 25th: Both arytenoids swollen with ulceration of right cord. Spraying commenced. September 1st: Right arytenoid swollen. Ulcer on cord healed.

Barach, Molomut and Soroka (1942) tried the effect of inhalation of nebulised promanide in experimental tuberculosis. They found a definite inhibition in guinea-pigs, the degree of pulmonary tuberculosis present at necropsy being less than in an orally-fed group. Reviewing our five laryngeal cases treated with a spray from the pulmonary point of view, no definite effect

on the lung condition could be attributed to the use of the spray, except in Case 4. This was the only laryngeal case to show transient symptoms of intolerance to the drug—mild depression, restlessness, insomnia and some cyanosis. The drug was withheld for 48 hours, during which time all these signs of intolerance disappeared completely and treatment was then resumed. A great improvement in the lung condition occurred, more, we thought, than could be attributed to bed rest alone; a cavity in the upper zone 1 inch in diameter closed in two months, and the E.S.R. dropped from 23 to 8.

As a result of this experience we decided to try the effect of promanide on two cases of bronchial tuberculosis. Mutch and Rewell (1945) have shown that 25 per cent. of penicillin in the form of a mist is deposited on the bronchial mucosa due to the turbulence produced in the bronchi by the change in direction of the air-flow in the alternating phases of respiration. Spraying, therefore, should bring promanide into close contact with the bronchial lesions.

CASE 10.—Male, aged 26, 1945. Bronchial tuberculosis, no stenosis present. Lung fields clear. Sputum positive for acid-fast bacilli—200 per microscope field. March 10th: Daily spraying with 40 per cent. promanide commenced. In addition promanide was run into the bronchi via the crico-thyroid route. March 9th: 0.4 gram promanide in 5 c.c. water injected. March 20th: 0.8 gram in 2 c.c. May 10th: 0.8 gram in 3 c.c. The condition gradually improved and by June 30th sputum was negative.

CASE 11.—Female, aged 29, 1945. Bronchial tuberculosis in association with a small parenchymatous lesion in left middle zone. March 10th: Spraying commenced. March 20th: 0.4 gram promanide in 5 c.c. water inserted through crico-thyroid. March 30th: Patient refused to continue treatment. Lesions improved.

It seems, therefore, that promanide must be brought into close contact with the diseased tissues to be of any use. With this principle in view three other cases have been treated, one of urogenital and two of intestinal tuberculosis complicating pulmonary disease.

CASE 1.—Male, aged 33, 1945. Bilateral pulmonary tuberculosis with involvement of both kidneys and bladder. Micturition every two hours day and night. May 7th: 0.2 gram promanide by mouth t.d.s. commenced. A urinary concentration of 35 milligrams per cent. and a blood concentration of 1 milligram per cent. was obtained on this dosage. Urinary output of promanide 0.585 milligram per day. May 30th: Micturition twice during night and three-hourly during day. June 30th: Symptomatic improvement maintained. Although in this case the generalised nature of the infection precluded a good result, the improvement that was found seems to us to make a trial on other purely urogenital cases worth while, since promanide, like the sulphonamides, is concentrated by the kidneys from the blood into the urine.

CASE 2.—Male, aged 27. Case of bilateral pulmonary tuberculosis who was making good progress until August, 1944. He then began to complain of malaise, nausea and discomfort on both sides of the abdomen. On examination there was deep tenderness in left hypochondrium. These symptoms cleared in a few weeks but returned in December. Weight had dropped 13 pounds. Gastric lavage and faeces showed the presence of acid-fast bacilli. Fractional test meal: sub-acidity. X-ray: some contraction of caput caeci, no fixation, no evidence of ulceration, a number of old and recent glands in R.I.F.; probably partly caseous. Screening; manipulation of caput caeci caused pain in left hypochondrium. Terminal ileum showed unusual appearance at the junction; caput caeci contracted as a whole; all freely mobile. Barium enema; colon contracted and shortened poorly. Caecum showed a close segmentation and ilio-caecal junction appeared plicated. He was treated by gastric self-lavage by the Spriggs technique, and acids were given by mouth. The gradual deterioration in his condition continued. March 14th, 1945: Temperature 97°-99° F. Loss of weight totalled 16 pounds. Promanide 0.1 gram by mouth t.d.s. because of the positive gastric lavage. 2 grams promanide in 3 ounces of water given P.R. twice weekly at 6 p.m. This

was run in slowly with the patient lying on his left side, and then he turned over on to his right side for half an hour. He retained this until the bowels were opened next morning. Subsequently no further loss of weight occurred. April 14th: Rectal promanide increased to thrice weekly. May 21st: Weight up 3½ pounds, Temperature 97°-98·8° F. June 6th: Weight increased a total of 13 pounds. July 23rd: Weight increased 16 pounds. Rectal promanide reduced to twice weekly. September 7th: Weight increased 26 pounds. No abdominal symptoms or signs. X-ray showed no abnormality in the bowel.

CASE 3.—Severe case of bilateral pulmonary tuberculosis which developed tubercular enteritis. Bowels open four times daily—a fluid, offensive-smelling stool. Temperature 99·6°-102° F. Diarrhoea not checked by any of the usual remedies. E.S.R. 63. He was given 0·2 gram promanide by mouth t.d.s. This gave a blood concentration of 1 milligram per cent. and a urinary concentration of 30 milligrams per cent. Daily output 0·4 gram promanide. After three weeks his bowels were open once daily only—a fluid stool. Six weeks later E.S.R. 30. Temperature 98·4°-100° F. Weight slowly increasing. A month later the promanide was accidentally discontinued for four days. Patient complained of loss of appetite, dull headache and increased sputum. Temperature range rose to 99·4°-101·6° F. On recommencing treatment the previous condition was restored in a couple of days.

Discussion

Our experience with promanide given systemically has been the same as that of other observers. We believe that systemic application probably fails because the drug is not effective at the low concentrations produced in the necrotic lesions of the human disease. Tytler (1945) considers that the regular continued administration of the sulphone compounds is valuable in keeping the undiseased tissues free from infection—*i.e.*, they will prevent the occurrence of new disease while other methods are being used to control the disease already present. The most likely cases for success with any drug are those with early and predominantly exudative lesions without evidence of massive tissue destruction or considerable fibrosis. Such was Case 3; and yet spread of disease occurred while undergoing systemic therapy.

As regards local therapy, we feel that the position is different. There is some evidence that if the drug can be brought into contact with the lesions in sufficient concentration the bactericidal effect produced by the drug allows healing to occur. This seems to be the case for cold abscesses, and here we feel that promanide is a valuable new therapeutic weapon. Tuberculous laryngitis, where the ulceration is superficial and lesions merely submucous, appears to benefit also. Healing in our cases seemed to be quicker than with rest treatment alone, and we feel that promanide may sometimes abolish the need for silence in patients undergoing sanatorium treatment except where the disease is advanced. Laryngeal lesions which are situated more deeply—*i.e.*, those involving intrinsic muscles or causing perichondritis under swollen oedematous tissues—cannot be expected to react so favourably. Actual injection of such lesions with promanide might perhaps give better results.

Promanide injected intravenously is quickly excreted by the kidney, with a consequent rapid fall in the blood level. With oral administration excretion is slower and the blood level is maintained much longer, although at a lower level, than with intravenous administration. Oral administration is, therefore, to be preferred despite all reports that toxic effects are more severe with oral treatment. Previous investigations (Heaf, Hurford, Eiser and Franklin, 1943; Dancey, Schmidt and Wilkin, 1944) have found that with oral therapy the promanide levels are higher in the urine than in the blood, and have

found an output, estimated colorimetrically, higher than the actual intake. From this it has been suggested that promanide given by mouth undergoes some alteration in the bowel, yielding a product which is slowly absorbed, is more toxic, and possibly more effective therapeutically. We therefore treated our later cases orally. With this method the urinary concentration, estimated according to Marshall (1937) with modifications (Marshall and Litchfield, 1938), was found to be much higher than the blood concentration. On a daily dosage of 0.6 gram promanide per day a blood concentration of 1 milligram per cent. was maintained, while the urinary concentration varied between 30 and 35 milligrams per cent. We were unable to confirm the previous finding that the output of promanide, estimated colorimetrically, was higher than the intake. The output in our cases was between 66 and 99 per cent. of the intake.

In tuberculous enteritis healing probably does not occur, but our patients were certainly made more comfortable.

Summary

Our experience with promanide in tuberculosis is described. Systemic treatment of pulmonary cases was found to be valueless. Used locally for cold abscesses and laryngitis, excellent results were obtained; and the improvement found in two intestinal cases and one urogenital case was promising. No confirmation was found of the previous finding that, with oral medication, the urinary excretion of promanide, estimated colorimetrically, is higher than the actual intake.

We wish to thank Dr. J. Stanley White, of Parke, Davis and Co., for the supply of promanide and Mr. J. W. Blair for his help.

REFERENCES

- BARACH, A. L., MOLOMUT, N. and SOROKA, M. (1942): *Amer. Rev. Tuberc.*, **46**, 268.
DANCEY, R. J., SCHMIDT, R. H., and WILKIE, J. M. (1944): *Amer. Rev. Tuberc.*, **44**, 510.
HEAF, F. R. G., HURFORD, J. V., EISER, A., and FRANKLIN, L. M. (1943): *Lancet*, **1**, 702.
HIMSHAW, H. C., and FELDMAN, W. H. (1941): *J.A.M.A.*, **117**, 1066.
HIMSHAW, H. C., PFUETZE, K., and FELDMAN, W. H. (1943): *Amer. Rev. Tuberc.*, **47**, 26.
MARSHALL, E. K. (1937): *Journ. Biol. Chem.*, **122**, 263.
MARSHALL, E. K., and LITCHFIELD, J. T. (1938): *Science*, **88**, 85.
MUTCH, N., and REWELL, R. E. (1945): *Lancet*, **1**, 650.
PICKERING, D., and GRENVILLE-MATHERS, R. (1945): *Lancet*, **1**, 530.
TYTLER, W. H., and LAPP, A. D. (1942): *Brit. Med. Journ.*, **2**, 748.
TYTLER, W. H. (1945): *Tubercle*, **26**, 23.
ZUCKER, G., PINNER, M., and HYMAN, H. T. (1942): *Amer. Rev. Tuberc.*, **46**, 277.

TRANSTHORACIC TRANSPLEURAL LIGATURE OF THE FIRST PART OF THE LEFT SUB- CLAVIAN ARTERY

By F. BRAITHWAITE

From an R.A.F. Hospital.

Introduction

LIGATURE of the first portion of a subclavian artery was first reported by Colles in 1813. The vessel ligatured was the right subclavian, which he approached through a supraclavicular incision. The indication for operation was a right traumatic subclavian aneurysm. Colles¹ stated that ligature of the first part of the left subclavian was not practicable in so far as the left subclavian is more difficult of access. Halsted² in 1892 ligatured the first part of the left subclavian in a patient aged 52 with an aneurysm of the left subclavian artery. The aneurysm was in the more distal portion of the vessel and allowed him a supraclavicular access to the first portion of the artery. He makes the following statement:

"The deligation of the first part of the left subclavian has been effected once before in 1846 by Dr. Kearney Rodgers of New York, and attempted once by Sir Astley Cooper. Dr. Rodgers' case terminated fatally on the sixteenth day from secondary hæmorrhage. Sir Astley Cooper abandoned the attempt at ligature under the impression that the thoracic duct had been wounded. The first part of the right subclavian has been deligated twelve or more times with a fatal result in each case. At least nine cases died from secondary hæmorrhage."

Surgical Anatomy

A consideration of the anatomical relationships of the two subclavian arteries will show why the right artery is more easy of access than the left. On the right side it takes origin behind the sterno-clavicular joint as a terminal branch of the innominate artery. On the left side it arises in the thorax from the aortic arch and ascends to enter the neck behind the left sterno-clavicular joint. The first part of each artery extends from its origin to the medial margin of the scalenus anterior. On each side it takes an arched course laterally on the front of the cervical pleura. It is crossed by the internal jugular and vertebral veins and by the vagus nerve. The common carotid artery is in front of it near its origin. On the left side three additional relations are present—namely, the phrenic nerve, the thoracic duct, and the left innominate vein. The ansa subclavia has similar relations on both sides.

The above brief survey of the anatomy of the subclavian vessels shows that the complication of the supraclavicular approach to either subclavian may be injury to the pleura or brachial plexus, and hæmorrhage from adjacent large vessels such as the internal carotid artery, the internal jugular and vertebral veins. On the left side in addition the thoracic duct may be injured and the left innominate vein is specially liable to injury. Furthermore, the supra-

clavicular approach to either vessel may be additionally complicated by the nature of the lesion for which ligature is proposed—for example, an aneurysm.

With an aneurysm the anatomy at the root of the neck may be grossly distorted. The aneurysm itself may be densely adherent to important structures and a difficult and dangerous dissection may be necessary before a proximal ligature can be applied. A supraclavicular approach in such cases may cut across any collateral circulation that has been formed since the accident. In such cases Henry³ considers the application of a ligature to the first part of the left subclavian a matter of such profound difficulty as to be almost impracticable. He has devised a posterior approach. Sencert⁴ approaches the subclavian vessels by means of a temporary resection of the clavicle. Touroff⁵ first performed a ligature of the left subclavian by means of a transthoracic transpleural approach. There is no doubt that this approach will keep the operator well away from any lesion in the neck that may necessitate ligature of the artery.

Case Report

L.C.L., age 22.—On the night of July 18, 1944, he baled out of a Lancaster bomber over Holland. Shortly after landing he was shot through the root of the left side of the neck by a German soldier who had taken him into custody. He felt progressively weaker, but an hour passed before he lapsed into unconsciousness. Though his memory was vague for the period between the shooting and the collapse, he thought that he was able to use his left arm during that time but he had no recollection of the state of his left hand. He was taken to hospital, where the wound in the neck was cleaned and a crepe bandage applied. He remained unconscious for twenty-four hours. When he awoke there was intense pain along the inner border of the left forearm and his hand felt useless. He noted that sensation was absent from the area of distribution of the ulnar nerve. From this time onwards there was progressive wasting of the small muscles of the hand—or, as he put it, the bones of the hand became more prominent and the fingers adopted a claw-like attitude. About two months after the accident he noticed a swelling at the root of the neck which pulsated, the pulsations being much stronger and more obvious after exercise. About the same time he also noticed that his left eyelid drooped more than the right and further that the left pupil was smaller than the right.

He was repatriated after the end of hostilities, and was admitted to this hospital on May 28, 1945. At that time there was ptosis of the left upper eyelid and the left pupil was smaller than the right. The right side of the face showed small beads of perspiration whilst the left side was dry. The thyroid cartilage was displaced as far as the medial margin of the right sterno-mastoid muscle. The vocal cords showed no abnormality. There was a small scar just above the left sterno-clavicular joint, marking the entry point of the bullet. Its exit wound was about an inch to the left of the spine of the first thoracic vertebra. In the root of the neck, occupying the supraclavicular fossa and covered by the lower end of the left sterno-mastoid, was a pulsating swelling. The swelling was not only pulsatile but also expansile. A murmur synchronous with the heart beat was heard over the swelling and was conducted down the axillary artery and heard in the left axilla. It was short and sharp in nature and not continuous. Identical blood pressure readings were obtained in both arms.

There was no limitation of passive movement of the left arm, but most of the muscles show definite loss of power. All the intrinsic muscles of the hand were paralysed, with some weakness of the radial extensors as well. There was no complete sensory loss in any area of the arm or hand and the finer grades of touch sensibility were retained on the radial portion of the hand. A sweating test showed loss of sweating on the left side of the face and neck and supraclavicular region, and along the lateral aspects of the entire arm. There was moderate sweating on the medial aspects of the arm and forearm and to a lesser degree along the ulnar distribution of the hand.

These signs suggested the following diagnoses: (1) Traumatic subclavian aneurysm; (2) a lesion of the brachial plexus maximal at the contributions of C8 and T1 (this lesion appears complete on the motor side but incomplete on the sensory side); (3) a lesion of the cervical sympathetic trunk, a few fibres of the latter having escaped, probably contribution from the second and third thoracic ganglia.

A barium swallow showed the trachea and œsophagus displaced considerably to the right, and damage to the transverse process of D1 was also seen in the films.

Electrocardiogram was normal, and a radiograph of the chest showed no cardiac enlargement.

Operation.—Anæsthesia by pentothal and ether with controlled respiration was given by J. D. Ebsworth. A transverse skin incision was made over the second left intercostal space beginning at the lateral border of the sternum and extending laterally to the anterior axillary line. This incision was converted into a "T" incision by the addition of a 2-inch vertical incision at its medial end. The second and third costal cartilages were divided close to the sternum and the internal mammary vessels divided between ligatures. The incision of the second intercostal space was deepened and the pleura opened. This allowed the second and third ribs to be adequately separated by means of a rib spreader. The upper lobe of the left lung was adherent to the pleura along its medial and superior aspects. It was gently dissected free and the proximal portion of the subclavian artery became visible. When the first inch of the subclavian and its origin from the aorta were clearly visible further dissection was discontinued. The subclavian artery was easily recognisable by means of the prominent fold which it causes in the pleura during its ascent to the root of the neck. The pleura over the aorta and the subclavian artery was incised for a length of $1\frac{1}{2}$ inches between the phrenic nerve anteriorly and the vagus nerve posteriorly. The superior intercostal vein was ligatured at this juncture to increase the ease of access. Small strands of the superior cardiac branch of the sympathetic and the inferior cardiac branch of the vagus were gently pushed aside with the pleura as dissection proceeded. The anterior leaf of the pleura was dissected forward until the common carotid artery was exposed. It was noted at the time how easily the common carotid artery could be ligatured through this approach if it was so desired. The innominate artery would present a little more difficulty. Compression of the subclavian artery caused the cessation of pulsations in the supraclavicular swelling. This swelling could be palpated bimanually. Occlusion of the subclavian artery caused no change in blood pressure or pulse rate, thus eliminating the possibility of an arterio-venous communication. Ligatures of braided silk were passed around the vessel and tied. Transfixion ligatures were also applied and the vessel divided. The mediastinal pleura was closed with interrupted sutures, the lung re-expanded by positive pressure and the wound closed without drainage.

The patient was given a course of sulphathiazole totalling 30 grammes. Two days after operation 370 c.c. of blood-stained fluid were removed from the left pleural sac by aspiration, and on the fourth day another 250 c.c. Thereafter convalescence was uninterrupted. The physical signs of the brachial plexus and sympathetic lesions remained unaltered. The swelling in the neck is no longer palpable.

Discussion and Conclusions

Late sequelæ of wounds at the root of the neck are infrequent because the original injury usually results in death. Halsted's² experience showed that even if patients survive the original injury, subsequent surgical treatment through a supraclavicular approach has a high mortality. Secondary hæmorrhage in his collected cases occurred nine times. In all probability hæmorrhage is due to sepsis. The site of operation, therefore, should be as far away as possible from the causative lesion in the neck, whether that lesion be aneurysm, malignant glands or sepsis. The thoracic approach is easy and convalescence in the case described was uneventful.

The common carotid artery is just as easily approached through this incision as the left subclavian, and in the cadaver the innominate artery, too, presents little more difficulty than the carotid or subclavian. On the right side the subclavian artery is as easy of access as on the left. The transthoracic transpleural approach to the vessels at the root of the neck is therefore preferable when the supraclavicular approach is difficult or dangerous. With controlled respiration during anæsthesia the technical difficulties of the operation are minimised, and it is possible to allow short periods of complete respiratory arrest to facilitate the actual ligation of the vessel.

REFERENCES

1. COLLES, 1815: *Edin. Med. and Surg. Journ.*, **11**, 1.
2. HALSTED, W. S., 1892: Collected papers, vol. 1, 312.
3. HENRY, A. K., 1921: "Exposure of Long Bones and other Surgical Methods." Bristol.
4. SENCERT, L., 1918: "Wounds of the Vessels." London.
5. TOUROFF, A. S. W., 1941: *Surgery*, **10**, 747.

[The author is indebted to the D.G.M.S., R.A.F., for permission to publish this paper.]

NOTICES OF MEETINGS

JOINT TUBERCULOSIS COUNCIL

At their meeting on February 16, 1946, the Joint Tuberculosis Council elected Dr. D. P. Sutherland, Senior Tuberculosis Officer, Manchester, as Chairman for the current year. Dr. Peter W. Edwards and Dr. G. Jessel were elected Vice-Chairmen, Dr. A. P. Ford, Hon. Treasurer, and Dr. Norman England, Hon. Secretary. The Council tendered cordial thanks to Dr. James Watts, the retiring Chairman, for his services.

An important report suggesting some changes in the definition of terms employed in tuberculosis work was approved and ordered to be forwarded to the Ministry of Health and the Department of Health for Scotland for their

observations. In this case, also, publication of the details was considered inadvisable at the moment, but the Council's suggestions will, in due course, appear in one of the series of J.T.C. reports which are by now familiar to tuberculosis workers.

The Council adopted a resolution stressing the value of the financial provisions for T.B. patients (Memorandum 266/T) and deploring the omission of similar provision from the National Insurance Act. A deputation was appointed to wait upon the Minister of National Insurance and the Minister of Health to urge the Council's views.

The Council received with gratification a letter from the Ministry of Labour and National Service, stating that the Minister had instructed his officers not to submit any girl under the age of eighteen years for training or employment in tuberculosis nursing.

The minutes of the Joint Education Committee (N.A.P.T. and J.T.C.) were approved, including a progress report on research work into the psychology of tuberculosis.

A memorandum on the teaching of tuberculosis to medical students, issued by the new Tuberculosis Educational Institute, was received, and the Council approved the following suggestions:

1. That physicians in charge of dispensaries and medical superintendents in charge of sanatoria should be appointed lecturers in medical schools situated in their areas.
2. That medical students should be attached to tuberculosis dispensaries as clinical clerks.
3. That facilities should be made available for short periods of residence at sanatoria for medical students wishing to make a further study of tuberculosis.

The Council agreed to become a member of the British Council for Rehabilitation.

NOTICES

GOLD COAST TUBERCULOSIS SURVEY

The National Association for the Prevention of Tuberculosis, which has already conducted medico-social surveys on tuberculosis in various parts of the British Commonwealth, is now undertaking, in co-operation with the Government of the Gold Coast, a survey of the problem in this colony. A Research Fellow, who will be a specialist doctor and have a technical assistant, is to be appointed to conduct a twelve months' medico-social survey, and the National Association for the Prevention of Tuberculosis will publish in due course a report of his findings.

TUBERCULOSIS EDUCATIONAL INSTITUTE

"TUBERCULOSIS INDEX AND ABSTRACTS OF CURRENT LITERATURE"

This is an entirely new quarterly journal published by the N.A.P.T. for the Tuberculosis Educational Institute. It will provide a complete list of articles on tuberculosis in world scientific and medical literature, and also abstracts of

the more important contributions. The entries and abstracts will be current. Each number of the index will review articles published in the preceding three-monthly period.

The journal will be of interest to all who require to keep in touch with the latest material published on tuberculosis, and to read summaries of the more important papers in a literature which is steadily increasing.

The index will be managed by the following Editorial Board: Frederick Heaf (Chairman), J. G. Scadding, W. H. Tytler, W. E. Snell, W. E. R. Saunders, W. R. Bett (Medical Librarian), with the assistance of R. Scott Stevenson (Laryngology), Frank Airey (Dermatology), S. Alan Malkin (Orthopædics), J. H. Carver (Genito-Urinary), Harley Williams (Editor). First issue, April, 1946.

TUBERCULOSIS EDUCATIONAL INSTITUTE

FORTHCOMING REFRESHER COURSES, 1946

Papworth and Cambridge Course for Medical Practitioners and Tuberculosis Officers at Papworth Village Settlement.

Dates: June 18-20.

Lecturers: Professor Sir Lionel Whitby, R. R. Trail, M.C., M.D., F.R.C.P., Norman F. Smith, M.D., Peter Kerley, M.D., M.R.C.P., D.M.R.E., F. R. G., Heaf, M.D., F.R.C.P., Professor Paterson Ross, F.R.C.S., J. B. Hunter, M.C., F.R.C.S., D. MacCallum, M.B., Ch.B., E. Brieger, M.D.

Fee for course of lectures and demonstrations: £2 2s.

Fee for three nights' accommodation at Girton College: £2 2s.

*London Course for Medical Practitioners and Tuberculosis Officers at London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.
On the Treatment of Tuberculosis.*

Dates: September 23-28.

Programme to be announced later.

Fee: £4 4s.

London Course for Almoners, Health Visitors, Social Workers and Chief Clerks at London School of Hygiene and Tropical Medicine, W.C.1.

Dates: September 26-28.

Programme to be announced later.

Fee: 10s.

Newcastle-on-Tyne Course for Medical Practitioners and Tuberculosis Officers.

Dates: November 4-8.

Programme to be announced later.

Fee: £4 4s.

Newcastle-on-Tyne Course for Almoners, Health Visitors, Social Workers and Chief Clerks.

Dates: November 7-9.

Programme to be announced later.

Fee: 10s.

Early application should be made to: Harley Williams, M.D., Tavistock House North, Tavistock Square, W.C.1.

REVIEWS OF BOOKS

Brompton Hospital Reports, Volume XIII. 1944. Pp. 174. Gale and Polden, Aldershot. Price 10s.

This volume of the Brompton Reports contains papers on a wide variety of subjects, medical and surgical, technical and non-technical.

As might be expected in 1944, a prominent place is given to war papers. Mr. Tudor Edwards gives a comprehensive review of the commoner wounds and injuries of the chest. Mr. Price Thomas indicates which operative measures should be undertaken by the surgeon not conversant with the technique of thoracic surgery. In the third paper on war wounds—"Penetrating Wounds of the Chest," by J. G. Scadding and W. F. Nicholson—the authors give their personal experience when serving with a Chest Team in the Middle East. On the medical side are two papers by Surgeon-Captain Brooks on fluorography as used in the Royal Navy, and the action taken when pulmonary tuberculosis was detected. The difficult cases are those which show lesions apparently inactive but of doubtful stability, and, as he points out, this problem will be even more complex when fluorography is applied to the civilian population.

Noteworthy in this volume is "Bronchial Embolism and Posture in Relation to Lung Abscess," by R. C. Brock, F. Hodgkiss and H. O. Jones. The importance of inhalation of infected material in the causation of lung abscess, and of posture in determining its site, are clearly shown, and evidence is produced in support of the view that the usual adult tuberculous lesions, Assman's focus and Ghon's focus are bronchogenic and not hæmatogenic in origin. Mr. Brock also contributes papers on "The Level of the Interlobar Fissures of the Lung" and "Surgical Treatment of Bronchial Carcinoma."

The non-technical papers, two in number, are contributed by Dr. Clifford Hoyle. In "Disease and its Significance in the Lives of Great Men" he reviews some of the many instances where disease in the great has left its mark on the nation. In "The Life and Discoveries of René Laennec" he paints a vivid picture of one of the greatest of French physicians, his discovery of the stethoscope and his masterly use of it.

The volume opens with a plea by Mr. J. E. H. Roberts for earlier reference of the suitable case to the thoracic surgeon, and closes with reports of a clinical meeting and investigations of artificial pneumothorax technique and of tuberculosis among the nursing staff. All of it will be of interest to the specialist, much of it to the general practitioner.

A Manual of Tuberculosis, Clinical and Administrative. By E. ASHWORTH UNDERWOOD. E. and S. Livingstone, Ltd., Edinburgh. Pp. 524. Price 15s.

The author sets out to provide a comprehensive account of tuberculosis in all its clinical forms. This is intended primarily as an introduction for students and medical men, but also for other T.B. workers. The greater part of the book is concerned with treatment and administration. Simple practical procedures are described in some detail and a good account of the principles of sanatorium care is given. It is easy in a book of this type to criticise the apportionment of space and the omissions. But the author succeeds within his limits in presenting a simple, readable, if somewhat uninspiring account of the management of tuberculosis as a whole.

Pulmonary Tuberculosis and the General Practitioner. By C. H. C. TOUSSAINT. The National Association for the Prevention of Tuberculosis. Price 1s.

This is a pamphlet containing fourteen pages of print besides some excellent reproductions of chest radiographs. It is designed to foster the earlier diagnosis of pulmonary tuberculosis, and for this the main stress is laid on the importance of the chest X-ray.

Short case histories accompanied by radiographs make up the bulk of it. It is well produced and deserves success.

Aids to Tuberculosis for Nurses. By L. E. HOUGHTON and T. HOLMES SELLORS. Baillière, Tindall and Cox, London. Price 4s.

In their Foreword to the Nurses' Aids Series the editors explain that "each volume is a complete textbook . . . and not an aid to the study of larger books." Certainly this is true of the new *Aids to Tuberculosis*, into which is packed an astonishing amount of information. After a brief account of the characteristics of the tubercle bacillus and the lesions it produces the symptoms and treatment of pulmonary tuberculosis are described, with a more detailed consideration of sanatorium régime. The nurse's part, both as assistant at medical and surgical procedures and in routine nursing of the patient, is most adequately detailed, and it is good to see the stress laid throughout the book on the psychological problems of tuberculous patients, and the help which a nurse can give. A shorter section deals with surgical tuberculosis, and finally some beautifully reproduced radiographs serve to stimulate interest in the radiological appearances of the disease. This is an excellent and all-embracing little book, and the nurse who has studied it should be a most valuable colleague to the doctor and friend to the patient.

Modern Treatment Yearbook, 1945. Edited by CECIL P. G. WAKELEY. The Medical Press and Circular, London. Price 15s.

Although this book is intended primarily for the general practitioner, the choice of its subjects will probably make it more of interest than of value to just these readers. Few general practitioners are likely to treat cancer of the penis, hydatid disease, fractures of the spine or peripheral nerve injuries, nor do they commonly perform Harris's prostatectomy. They will, however, be interested to read how their patients with these diseases are treated by the specialist, and will be aided in recognising them by the sections on diagnosis which begin each article. A number of medical conditions which normally receive domiciliary treatment are included, and among these are several articles on chest diseases, two of which deal very comprehensively with the management of tuberculosis in young people. Some of the therapeutic measures presented are matters for disagreement, such as the recommendation that only the large hæmothorax should be aspirated, the smaller ones being left to control hæmorrhage by collapse of the underlying lung, and that the infected hæmothorax should be treated with aspirations and "M. and B. 693," the opinion of a surgeon being sought in severe infections. With the rapid development of chemotherapy some of the treatment advocated is already out of date; penicillin is proving itself more hopeful than sulphonamides in infective endocarditis, and few people would consider sulphathiazole the sulphonamide of choice in meningococcal meningitis, nor subcutaneous injection a safe route for its administration. This book contains a number of interesting and a few useful articles, and is on the whole better where it deals with diagnosis than with treatment.

The Papworth Families. A Twenty-five Years' Survey. By M. BRIEGER. William Heinemann. Medical Books Ltd. 1944. Price 45s.

Papworth and Sir Pendrill Varrier-Jones are household words and the publication of the results of observations over twenty years is an important landmark in the tuberculosis world.

Varrier-Jones always made the point that before he was justified in publishing results or drawing conclusions on an important clinical experiment such as the Papworth Village Settlement sufficient time must elapse for observation and following up. In 1936 he selected Dr. E. M. Brieger to correlate and publish the observations of twenty-five years at Papworth, and arranged that all case histories, X-rays and other data should be at his disposal. Dr. Brieger has spent his life in the study of tuberculosis; he was in charge of a Tuberculosis Colony near Breslau, and has done important work on the Rehabilitation Committee of the International Union against Tuberculosis. He could be counted upon for a scientific and critical report on the clinical material supplied to him by Dr. Stott, who, with Sir Varrier-Jones, might be considered biased by virtue of their intimate knowledge of the families and patients in the Papworth Village.

The Papworth Families, containing these results, is a book which requires and repays careful study; so much detail is given (for example, the various subdivisions of changes seen in the X-ray films) that concentration is required to understand it all.

Papworth Village Settlement was started in 1918 with 8 cottages, and has steadily increased, so that in 1938 there were thriving industries, with 142 families, some 500 unmarried colonists and 368 children. The follow-up history of residents has been brought up to 1942, but the members of families who have left the Settlement, on the death of the head of the family or from other causes, have not been so closely followed.

From 1918 to 1938, 199 ex-patients' families have lived in the village with the families of some 30 members of the staff. Of the 199 ex-patients' families, 62 were childless, 77 are still in residence, 33 have left following the death of the head of the family, and 27 families with children have left for other reasons. Of the 137 families *with children*, 97 remained for less than 10 years and 40 for more than 10 years.

Of the 137 heads of families with children, 120 had pulmonary tuberculosis, of which 90 had a positive sputum at some time. Of the remaining 30 cases, many showed gross calcification in the X-ray films, suggestive of active lesions in the past. Roughly one-third of the 120 cases could be assessed as "potentially healed," with negative sputum for over 2 years; one-third were "bad chronics," with persistently positive sputum and cavitation, most of which have died. The remaining third were assessed as "middle cases," with persistent cavities and periodically or permanently positive sputum. Under observation a proportion became "healed" cases, and the remainder deteriorated to the "bad chronic" category. It is not easy to pick up all the information desirable from the tables and the case histories—*e.g.*, details as to the degree of "collapse" attained by the therapeutic measures employed.

The information on the children in the resident families is most interesting and the gloomy prophecies made originally have not been borne out. Of 108 children *born in the village*, not a single one has developed any clinical tuberculosis, and the mortality from other causes has been extremely low. Radiological results were as follows:

51%	..	..	..	..	..	..	Nil.
43%	..	..	..	..	..	..	Calcified foci.
4.6%	..	..	..	..	..	..	Abortive primary lung lesion.
1.9%	..	..	..	..	..	..	Transient perifocal reaction.

Twenty-five children were born of families with a positive sputum, with the following radiological findings:

16	..	..	..	..	..	..	Nil.
2	..	..	..	..	..	..	Primary complex.
5	..	..	..	..	..	..	Calcified foci.
1	..	..	..	..	..	..	Transient perifocal reaction.
1	..	..	..	..	..	..	Residual primary infection.

None showed any clinical manifestation of tuberculosis.

In 260 children *admitted* to Papworth the figures were very different, and the radiological findings in the group of 151 children of sputum-positive families were:

Nil	..	..	..	..	..	..	37 (24.5%)
Ghon's foci	..	..	..	..	..	..	9 (5.9%)
Calcified foci	..	..	..	..	..	..	64 (42.4%)
Residuum of primary infection	..	..	..	..	..	..	25 (16.6%)
Transient perifocal reactions	..	..	..	..	..	..	3 (2%)
Childhood tuberculosis	..	..	..	..	..	..	4 (2.7%)
Adult phthisis	..	..	..	..	..	..	9 (5.8%)

13 with clinical disease,
mainly in girls.

The tuberculin skin tests were made by Moro's tuberculin ointment, with re-examination by Hamburger's concentrated ointment, and the figures from 1921 to 1931 on 171 children were as follows:

Age.	Positive Reaction.
1-5	.. .. 56.8%
5-10	.. .. 59.0%
10-15	.. .. 69.5%

Of the 112 positive reactors, 16 cases showed some form of tuberculous disease: the positive reactors were found alike in homes with and without a positive sputum case.

The average age of the village-born children in 1938 in the families of the sputum-positive cases was five years, that of the sputum-negative and surgical families six years, and of families of the healthy staff nine years.

Dr. Brieger gives an interesting historical review of the problems of tuberculosis, particularly in regard to infection. He states his opinion on the epidemiology and modes of infection, and concludes that the original primary tuberculous infection is the source of adult phthisis, with the suggestion that the larger the original infection, the greater the risk of adult phthisis. The cases quoted to support this theory are not from Papworth (none of the village-born children has so far developed clinical tuberculosis), but are cases previously under the care of Dr. Brieger. From the clinical and radiological data supplied the evidence, although suggestive, is not sufficiently strong to convince a sceptic.

There are some of us who have been impressed by the mass radiography surveys among young adolescents in the Services, with and without well-marked calcification and Ghon's foci, and the apparent relationship to infection from open cases, and who, in addition, remember the follow-up of adolescent contacts in sputum-positive families which show that there is a greater risk of

adult phthisis in these contacts than in other persons in similar age groups not so exposed to contact infection. To us the inference that re-infection or super-infection takes place in these contacts is very strong, and Dr. Brieger's evidence on his survey of the Papworth families, supporting his theory that the primary infection is always the source of adult phthisis, is not convincing.

The survey of the first twenty-five years of the Papworth experiment is most stimulating and far-reaching in its implications. The faith and confidence of Varrier-Jones is well vindicated, and one hopes that the experiment will continue and that with each succeeding decade a report on the follow-up of all members of the community will give an answer to many problems still unsolved.

A Textbook of the Practice of Medicine. By VARIOUS AUTHORS. Edited by FREDERICK W. PRICE, M.D., C.M., F.R.C.P., F.R.S.Edin. Seventh Edition, 1946. GEOFFREY CUMBERLEGE, Oxford University Press, London. Price 42s.

We can sympathize with the editor in his remarks on the task of revision of this well-known textbook for this seventh edition; for it must indeed have been a herculean labour. The result, however, is a worthy tribute to British medicine: a readable, well-balanced, detailed and up-to-date account of its subject. If the book has a fault it is the lack of illustration; and that, perhaps, strikes a reviewer concerned particularly with diseases of the chest; for in the section dealing with that part of medicine not one single radiograph appears. If one might forgive the omission in other sections, surely here a few typical pictures ought to have been included. To study thoracic medicine without X-rays at hand is like studying art without access to the work of the artist.

Although many changes have been made in this edition, the section on respiratory diseases remains substantially the same. A new article on "Primary Atypical Pneumonia" is included, and the newer tuberculin tests, bagassosis, pneumoperitoneum, closed suction drainage of tuberculous cavities, the use of the newer sulphonamides in pneumonia, mass radiography and the surgical treatment of patent ductus arteriosus receive mention. The difficulty always in textbooks which cover so large a field is to strike the happy mean between what to include and what to leave out, and on the whole this book undoubtedly solves that difficulty well. It is sufficiently precise to serve the student and yet sufficiently detailed to remain a work of reference later on. Perhaps its usefulness in the latter respect might be increased if in future editions each contributor appended a short list of monographs relevant to his subject; for the recently qualified would find such a list a handy introduction to the wider fields of reading that they need, and even a brief guide can save much wasted time and effort for the youthful seeker.